9th Class 2015

Physics	Group-I	Paper-I
Time: 15 Minutes	(Objective Type)	Marks: 12

Note: Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink. Cutting or filling two or more circles will result in zero mark in that question.

1-(i) Which of the substance is the lightest:

(a) Copper (b) Mercury
(c) Aluminium √ (d) Lead

(ii) In gases heat is mainly transferred by:

(a) Molecular collision (b) Conduction
(c) Convection √ (d) Radiation

(iii) The kinetic energy of a body of mass 2 kg is 25 J. Its speed is:

(a) 5 ms^{-1} √ (b) 125 ms^{-1}
(c) 25 ms^{-1} (d) 500 ms^{-1}

(iv) The motion of a body about an axis is called:

(a) Circular motion (b) Rotatory motion √
(c) Vibratory motion (d) Random motion

(v) Which of the following material lowers friction when pushed between metal plates:

(a) Water (b) Fine marble powder
(c) Air (d) Oil √

(vi) Mathematically first condition of equilibrium is represented as:

(a) $\Sigma F = 0$ √ (b) $\Sigma \tau = 0$
(c) $\Sigma R = 0$ (d) $\Sigma N = 0$

(vii) **The orbital speed of a low orbit satellite is:**

(a) Zero (b) $8\ ms^{-1}$

(c) $800\ ms^{-1}$ (d) $8000\ ms^{-1}$ √

(viii) **The co-efficient of linear expansion and volume expansion are related by the equation:**

(a) $\beta = \alpha$ (b) $\beta = 3\alpha$ √

(c) $\beta = 2\alpha$ (d) $\beta = \frac{\alpha}{2}$

(ix) **Volume of one litre is equal to:**

(a) $1\ cm^3$ (b) $10\ cm^3$

(c) $100\ cm^3$ (d) $1000\ cm^3$ √

(x) **The net torque acting on a rotating body with uniform speed is:**

(a) 1 (b) 2

(c) 5 (d) 0 √

(xi) **Newton's first law of motion is valid only in the absence of:**

(a) Force (b) Net force √

(c) Friction (d) Momentum

(xii) **Which of the following in a vector quantity:**

(a) Speed (b) Distance

(c) Displacement √ (d) Power

9th Class 2015		
Physics	Group-I	Paper-I
Time: 2.45 Hours	(Subjective Type)	Marks: 63

(Part-I)

2. Write short answers to any Five (5) question: 10

(i) Write the definition of Physics.

Ans In Physics, we study matter, energy and their interaction.

(ii) What is meant by derived quantities? Give an example.

Ans Those physical quantities which are expressed in terms of base quantities are called the derived quantities. These include area, volume, speed, force, work, energy, power, electric charge, electric potential, etc.

(iii) Differentiate between Scalars and Vectors.

Ans A physical quantity which can be completely described by its magnitude is called a scalar. A vector can be described completely by magnitude along with its direction.

(iv) Differentiate between speed and velocity.

Ans The distance covered by an object in unit time is called is speed. The rate of displacement of a body is called its velocity.

(v) Define acceleration and write its formula.

Ans Acceleration is defined as the rate of change of velocity of a body.

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time taken}}$$

$$a = \frac{v_f - v_i}{t}$$

(vi) Define momentum and write its unit.

Ans Momentum of a body is the quantity of motion it possesses due to its mass and velocity. Momentum is a vector quantity. Its SI unit is $kgms^{-1}$.

(vii) Differentiate between mass and weight.

Ans 1. Mass is scalar but weight is vector.

2. Mass is a fixed quantity at any place whereas weight of a body will be different at different places due to different values of g.

(viii) Define centripetal force and write its mathematical form.

Ans Centripetal force is a force that keeps a body to move in a circle.

$$F_c = \frac{mv^2}{r}$$

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3. Write short answers to any Six (6) questions: 12

(i) Differentiate between like and unlike parallel forces.

Ans Like parallel forces are the forces that are parallel to each other and have the same direction.

Unlike parallel forces are the forces that are parallel but have directions opposite to each other.

(ii) Why a body cannot be in equilibrium due to a single force acting on it?

Ans Because a body is said to be in equilibrium if no net force acts on it.

(iii) Differentiate between axis of rotation and moment arm.

Ans Consider a rigid body rotating about a line. The particles of the body move in circles with their centres all

lying on this line. This line is called the axis of rotation of the body.

The perpendicular distance between the axis of rotation and the line of action of the force is called the moment arm of the force.

(iv) What is meant by the force of gravitation?

Ans Newton concluded that there exists a force due to which everybody of the universe attracts every other body. He named this force the force of gravitation.

(v) If R is doubled then what will be change in equation $g = \frac{GM_e}{R^2}$.

Ans If R is doubled then the change in equation $g = \frac{GM_e}{R^2}$ will become one ninth of its value on the earth.

(vi) Define kinetic energy and write its equation.

Ans The energy possessed by a body due to its motion is called its kinetic energy.

$$K.E. = \frac{1}{2} m v^2$$

(vii) Define work and write its unit.

Ans Work is done when a force acting on a body displaces it in the direction of a force. SI unit of work is joule (J).

(viii) Define sound energy.

Ans Sound is a form of energy. It is produced when a body vibrates; such as vibrating diaphragm of a drum, vibrating strings of a sitar and vibrating air column of wind instruments such as flute pipe etc.

(ix) Who predicted mass-energy equation? Also write its equation.

Ans Einstein predicted mass-energy equation. Its equation is:

$$E = mc^2$$

4. Write short answers to any Five (5) questions: 10

(i) Define pressure and give its unit.

Ans The force acting normally per unit area on the surface of a body is called pressure.

Pressure is a scalar quantity. In SI units, the unit of pressure is Nm^{-2} also called pascal (Pa). Thus

$$1\ Nm^{-2} = 1\ Pa$$

(ii) State the Pascal's Law.

Ans Pascal's law is stated as:

"Pressure applied at any point of a liquid enclosed in a container, is transmitted without loss to all other parts of the liquid."

(iii) What is meant by thermal equilibrium?

Ans Temperature determines the direction of flow of heat. Heat flows from a hot body to a cold body until thermal equilibrium is reached.

(iv) Write two uses of bimetallic strip.

Ans Bimetal strips are used for various purposes. Bimetal thermometers are used to measure temperatures especially in furnaces and ovens. Bimetal strips are also used in thermostats.

(v) What is meant by upper and lower fixed points of thermometer?

Ans A thermometer has a scale on its stem. This scale has two fixed points. The lower fixed point is marked to show the position of liquid in the thermometer when it is placed in ice. Similarly, upper fixed point is marked to show the position of liquid in the thermometer when it is placed in steam at standard pressure above boiling water.

(vi) Define specific heat.

Ans Specific heat of a substance is the amount of heat required to raise the temperature of 1 kg mass of that substance through 1K.

(vii) **What is meant by Green House Effect?**

Ans As the concentration of CO_2 in air increases, less heat energy is lost from the surface of the Earth. Therefore, the average temperature of the surface gradually increases. This is called green house effect.

(viii) **Describe the effect of length of the solid on thermal conductivity.**

Ans Larger is the length between the hot and cold ends of the solid, more time it will take to conduct heat to the colder end and smaller will be the rate of flow of heat. Thus

$$\text{Rate of flow of heat } \frac{Q}{t} \propto \frac{1}{L}$$

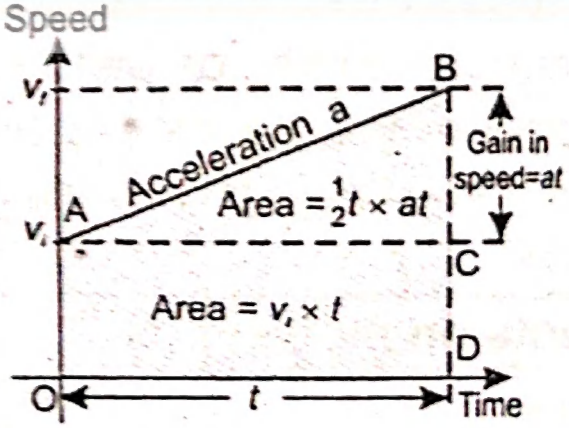
(Part-II)

Note: Attempt any Three (3) questions.

Q.5.(a) Derive the second equation of motion with the help of speed-time graph. (4)

Ans **Second equation of motion:**

In speed-time graph shown in the following figure, the total distance S travelled by the body is equal to the total area OABD under the graph.



Total distance S = area of (rectangle OACD + triangle ABC)

Area of rectangle OACD = OA × OD

= $v_i \times t$

Area of the triangle ABC = $\frac{1}{2}$ (AC × BC)

$$= \frac{1}{2} t \times at$$

Since Total area OABD = area of rectangle OACD + area of triangle ABC

Putting values in the above equation, we get

$$S = v_i t + \frac{1}{2} t \times at$$

$$S = v_i t + \frac{1}{2} at^2$$

(b) What are the measuring instruments? Explain the meter rod. (3)

Ans Measuring instruments are used to measure various physical quantities such as length, mass, time, volume, etc.

The Meter Rod 'OR' The Meter Rule:

A metre rule is a length measuring instrument. It is commonly used in the laboratories to measure length of an object or distance between two points. It is one metre long which is equal to 100 centimetres. Each centimeter (cm) is divided into 10 small divisions called millimeter (mm). Thus one millimetre is the smallest reading that can be taken using a metre rule and is called its least count.

While measuring length, or distance, eye must be kept vertically above the reading point. The reading becomes doubtful if the eye is positioned either left or right to the reading point.

Q.6.(a) Write a note on momentum. (4)

Ans **Momentum:**

Momentum of a body is the quantity of motion it possesses due to its mass and velocity.

A bullet has a very small inertia due to its small mass. But why does its impact is so strong when it is fired from the gun?

On the other hand, the impact of a loaded truck on a body coming its way is very large even if the truck is moving slowly. To explain such situation, we define a new physical quantity called momentum.

The momentum P of a body is given by the product of its mass m and velocity v. Thus

$$P = mv$$

Momentum is a vector quantity. Its SI unit is $kgms^{-1}$.

(b) The steering of a car has a radius 16 cm. Find the torque produced by a couple of 50 N. (3)

Ans Distance between forces = AB = 16 + 16

$= 32$ cm

$= \frac{32}{100}$ m

$= 0.32$ m

$F = 50$ N

$T = r \times F$

$T = rF$

$T = 0.32 \times 50$

$T = 16$ Nm

Q.7.(a) Determine the mass of Earth using the Law of Gravitation. (4)

Ans Consider a body of mass m on the surface of the Earth. Let the mass of the Earth be M_e and radius of the Earth be R. The distance of the body from the centre of the Earth will also be equal to the radius R of the Earth. According to the law of gravitation, the gravitational force F of the Earth acting on a body is given by

$$F = G \frac{m M_e}{R^2}$$

But the force with which Earth attracts a body towards its centre is equal to its weight w. Therefore,

$$F = w = mg$$

or $mg = G\frac{m M_e}{R^2}$

$\therefore \quad g = G\frac{M_e}{R^2}$

and $M_e = \frac{R^2 g}{G}$ ... (i)

Mass M_e of the Earth can be determined on putting the values in equation (i).

$$M_e = \frac{(6.4 \times 10^6\ m)^2 \times 10\ ms^{-2}}{6.673 \times 10^{-11}\ Nm^2\ kg^{-2}}$$

$$= 6.0 \times 10^{24}\ kg$$

Thus, mass of the Earth is 6×10^{24} kg.

(b) A car weighing 12 kN has speed of 20 ms^{-1}. Find the kinetic energy. (3)

Ans **Given Data:**

Weight of the car $w = 12$ kN

$= 12 \times 1000\ N = 12000\ N$

Speed of the car $v = 20\ ms^{-1}$

To find:

Kinetic energy K.E = ?

Calculations:

Using the formula,

$$K.E = \frac{1}{2} mv^2$$

We know that

$$w = mg \text{ or } m = \frac{w}{g}$$

$$m = \frac{12000\ N}{10}$$

$$= \frac{12000}{10}$$

$$m = 1200\ kg$$

$$\text{Thus K.E.} = \frac{1}{2} \times 1200 \times (20)^2$$

$$= 600 \text{ Kg} \times 400$$

$$= 240000 \text{ J}$$

$$= 240 \times 10^3 \text{ J}$$

$$\text{K.E} = 240 \text{ kJ}$$

Q.8.(a) Define Young's Modulus and derive its equation. (4)

Ans The ratio of stress to tensile strain is called Young's modulus. Mathematically,

$$\text{Young's modulus } Y = \frac{\text{Stress}}{\text{Tensile strain}}$$

Let ΔL be the change in length of the rod, then

$$\Delta L = L - L_o$$

Since $\text{Stress} = \frac{\text{Force}}{\text{Area}} = \frac{F}{A}$

and $\text{Tensile strain} = \frac{L - L_o}{L_o} = \frac{\Delta L}{L_o}$

As $Y = \frac{\text{Stress}}{\text{Tensile strain}}$

$$= \frac{F}{A} \times \frac{L_o}{\Delta L}$$

$$\therefore \quad Y = \frac{F L_o}{A \Delta L}$$

SI unit of Young's modulus is Newton per square metre (Nm^{-2}).

(b) The mass of 200 cm^3 of stone is 500 gram. Find its density. (3)

Ans

$$m = 500g$$

$$V = 200 \text{ cm}^3$$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$= \frac{500g}{200\ cm^3} = 2.5\ g\ cm^{-3}$$

Thus the density of stone is 2.5 g cm^{-3}.

Q.9.(a) Write use of conductors and non-conductors. (4)

Ans **Use of conductors and non-conductors**

Uses of good conductors:

Good conductors are used when quick transfer of heat is required through a body. Thus cookers, cooking plate, boiler, radiators and condensers of refrigerators, etc. are made of metals such as aluminium or copper. Similarly, metal boxes are used for making ice, ice cream, etc.

Uses of non-conductors:

Insulators or bad conductors are used in home utensils such as handles of sauce-pans, hot plates, spoons, etc. They are made up of wood or plastic. Air is one of the bad conductors or best insulator. That is why cavity walls i.e., two walls separated by an air space and double glazed windows keep the houses warm in winter and cool in summer. Materials which trap air i.e., wood, felt, fur, feathers, polystyrenes, fibre glass are also bad conductors. Some of these materials are used for laggings to insulate water pipes, hot water cylinders, ovens, refrigerators, walls and roofs of houses. Woollen cloth is used to make warm winter clothes.

(b) How much heat is required to change 100 g of water at 100°C into steam? (Latent heat of vaporization of water is 2.26×10^6 J kg^{-1}.) (3)

Ans

$\Delta Q = ?$

$m = 0.11$ g

H..

(Part-III)

(Practical Part)

Note: Attempt any Two (2) questions.

A- Find the value of 'g' by free fall method with given reading in table. **(5)**

Sr. No.	Initial position	Black mark position	Height
	h_2	h_2	$h = h_2 - h_1$
1.	10 cm	80 cm	
2.	15 cm	90 cm	

10 Time for 10 Vib : t = 16.10 s

G Find the value of g = -------

Ans For 10 cm 'h'

$h = h_2 - h_1$

$= 80 - 10$

$= 70$

For 15 cm 'h'

$h = h_2 - h_1$

$= 90 - 15 = 75$

$T = \frac{t}{10} = \frac{16.10}{10}$

$\boxed{T = 1.61.\ s}$

$g \text{ for } 10 \text{ cm} = \frac{32\ h}{T^2}$

$= \frac{(32)\ (70)}{2.59}$

$= \frac{2240}{2.59}$

$= 864.86$

$g \text{ for } 15 \text{ cm} = \frac{32\ h}{T^2}$

$$= \frac{(32)(75)}{2.59}$$

$$= \frac{2400}{2.59}$$

$$= 926.64$$

B- Prove that the time period of simple pendulum is independent of mass using given data. (5)

$l = 100$ cm

Sr. No.	Mass (gm)	Time for 20 Vib t_1	t_2	$t = \frac{t_1 + t_2}{2}$	$T = \frac{t}{20}$
1	50 gm	40 s	39.5 s		
2	100 gm	40 s	40.1 s		
3	120 gm	40 s	40 s		

Average time period T = ------- s

Ans

Sr. No.	Mass (gm)	Time for 20 Vib t_1	t_2	$t = \frac{t_1 + t_2}{2}$	$T = \frac{t}{20}$
1	50 gm	40 s	39.5 s	$\frac{40 + 39.5}{2}$ = 39.75	$\frac{39.75}{20}$ = 1.9875
2	100 gm	40 s	40.1 s	$\frac{40 + 40.1}{2}$ = 40.05	$\frac{40.05}{20}$ = 2.0025
3	120 gm	40 s	40 s	$\frac{40 + 40}{2}$ = 40	$\frac{40}{20} = 2$

Average time period:

$$T = \frac{1.9875 + 2.0025 + 2}{3}$$

$$= \frac{5.99}{3} \text{ s}$$

$$T = 1.997 \text{ s}$$

C-(i) Define boiling point. (2,3)

Ans The temperature at which liquid starts boiling is called its boiling point.

(ii) What will happen if water is heated more and more? Also define melting point.

Ans If water is heated more and more, it leads to the process of evaporation.

The temperature at which a solid starts melting is called its fusion point or melting point.